Attachment 4: Impact of Tier 0 Retirement Credit toward Retrofits In-Use Off-road Diesel Vehicle Regulation

Background:

At the July 26, 2007 Air Resources Board (Board or ARB) meeting, the Board voted to adopt the proposed in-use off-road diesel vehicle regulation, along with some additional modifications. One of the modifications approved by the Board was to give particulate matter (PM) retrofit credit for the retirement of Tier 0 vehicles such that equivalent emission reductions are achieved. Discussion of this change during the Board meeting centered on giving relief to fleets that are shrinking due to difficult economic times.

Staff has incorporated this change into the proposed 15-day changes. Staff added the following language to the regulation, "**Retirement of Tier 0 Vehicles in Lieu of Retrofitting for Fleets with Reduced Horsepower** - If since March 1 of the previous year, a fleet's total maximum power has decreased, the lesser of the total maximum power of Tier 0 vehicles retired since March 1 of the previous year and the total horsepower by which the fleet has been decreased may be counted toward the required hp to be retrofit under section 2449.2(a)(2)(A)1. Such retirement of Tier 0 vehicles may not be used to accumulate carryover PM retrofit credit. Retired Tier 0 vehicles that are counted toward the required hp to be retrofit under this subsection may not be used in subsection a. above to demonstrate that the fleet retired Tier 0, 1, 2, or 3 engines with at least the total maximum power of the Tier 4 engines added." Because this new provision will reduce the amount of PM exhaust retrofits required, it is expected to reduce the emission benefits achieved by the regulation.

This paper documents staff's estimate of the impact the change will have on the emissions benefits of the regulation. Staff concluded that the change will slightly decrease the emission benefits expected from the regulation, with the effect being larger in years when the economy is bad and smaller when the economy is good. Overall, staff does not expect that the change in emission benefits due to the change will be significant.

Analysis Results:

To estimate the impact on emissions benefits, staff first examined the impact if all fleets were shrinking and therefore could count any retirement of a Tier 0 vehicle toward the required percent of retrofit. Staff ran the ARB Off-road Compliance Model Version 3.3 for this scenario and found the emissions impact shown in Table 1. The new provision achieves less PM benefits than the baseline rule because it requires fewer PM exhaust retrofits of fleets. The new provision achieves less NOx benefits because when fleets install fewer PM retrofits, they cannot utilize the provision that delays turnover until after a retrofit is at least 6 years old. Therefore, in order to meet the NOx turnover requirements of the regulation, fleets end up turning over to Tier 3 rather than Tier 4 vehicles, which results in fewer NOx benefits.

Table 1: Overall Loss in Total Emissions Benefit for 2010 through 2025 if All Fleets Shrinking

Loss in NOx Benefits	Loss in PM Benefits	Loss in PM2.5 Equivalent Benefits[1]
3%	6%	5%

The losses in benefits vary from year to year depending on how many Tier 0s are being retired. The losses would be greatest in the early years of rule implementation when the most Tier 0s still remain in the fleet and are still being retired. Staff found that in the first years of rule implementation, losses in benefits could be as high as 23% per year if all fleets were shrinking, and stayed in business and took advantage of the new provision to reduce the amount of retrofits they had to do. In reality, even in the worst economic times, not all fleets will be shrinking, so the impacts shown in Table 1 are a worst-case upper bound estimate of impacts.

Table 2 contains an estimate of the impacts if 10 percent of fleets were shrinking and stayed in business and took advantage of the new provision to reduce the amount of required retrofits. It is impossible to predict with accuracy what fraction of fleets would be shrinking and also staying in business in any year, but staff estimates that 10 percent is a reasonable ball-park estimate of the portion of fleets in that situation in any year. The overall loss in benefits in terms of PM2.5 equivalent tons over the course of the regulation was less than 0.5%, and – even in the year of maximum impact - losses in benefits would be no higher than 2.3%. Staff judged this to be an insignificant loss in emission benefits.

Table 2: Overall Loss in Total Emissions Benefit for 2010 through 2025 if 10% of Fleets Are Shrinking in Any Year

Loss in NOx Benefits	Loss in PM Benefits	Loss in PM2.5 Equivalent Benefits[1]
0.3%	0.6%	0.5%

Appendix 1 contains the spreadsheets used to estimate the emission benefits.

[1] PM2.5 equivalent tons are the sum of diesel PM tons plus 1/27th of the NOx tons (which is the NOx/PM 2.5 conversion factor). This conversion is based on the approximate relative health effects of direct diesel PM versus indirect PM formed in the atmosphere from NOx emissions, based on the health impacts for the proposed in-use off-road diesel vehicle regulation estimated in the *Technical Support Document: Proposed Regulation for In-Use Off-road Diesel Vehicles* (ARB, 2007).

Appendix 1: Impact on Emissions Benefits

Credit for T0 retirement PM+NOx/27	Baseline PM+NOx/27	Annual % loss in benefit	Calendar Year
1.85	2.40	23%	2010
3.63	4.81	25%	2011
4.89	6.16	21%	2012
5.68	6.66	15%	2013
7.14	7.59	6%	2014
7.76	8.17	5%	2015
8.06	8.28	3%	2016
8.13	8.15	0%	2017
7.70	7.93	3%	2018
7.49	7.32	-2%	2019
7.43	6.98	-6%	2020
6.77	6.31	-7%	2021
5.89	5.72	-3%	2022
5.10	4.98	-2%	2023
4.58	4.60	0%	2024
3.97	4.03	2%	2025
3.51	3.53	1%	2026
3.10	3.10	0%	2027
2.77	2.75	0%	2028
2.39	2.33	-2%	2029
2.23	2.22	0%	2030

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